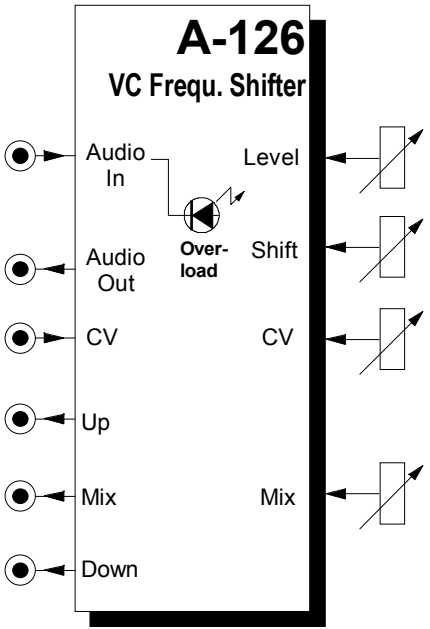


1. Introduction

Module **A-126** (**VCFS**) is a **voltage-controlled frequency shifter.**

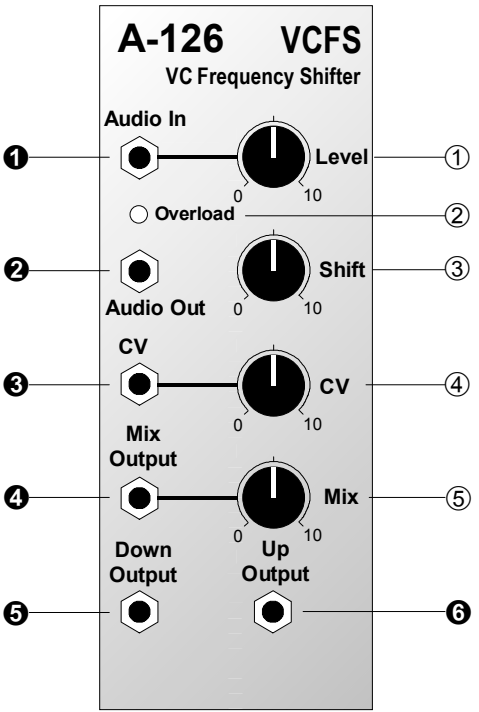
The amount of **frequency shift** can be varied from about 50 Hz up to 4 kHz, either manually, or by voltage control (via an attenuator).

The **amount of input signal** gain can be controlled with the **Level** knob.

The **upward- (Up)** and **downward- (Down)** shifted signals are available at **separate outputs**, and also at the **Mix output**, where a mix of the two frequency-shifted signals is available, with the balance controlled by a **Mix** knob.

The **Audio Out** socket provides an amplified but not frequency-shifted version of the original input signal.

2. VCFS - Overview



Controls:

① **Level** : gain control for the signal connected to input ❶

② **Overload** : LED overload warning light for the input signal

③ **Shift** : control for manual frequency-shifting

④ **CV** : attenuator for the frequency-shifting control voltage at input ❸

⑤ **Mix** : control to balance the relative amounts of Up and Down frequency-shifted signals at output ❹

In / Outputs:

❶ **Audio In** : audio input (line level)

❷ **Audio Out** : audio output (the original signal amplified but not frequency-shifted)

❸ **CV** : control voltage input for pitch-shifting

❹ **Mix Output** : mix output for Up and Down signals

❺ **Down Output** : output for just the downward-shifted audio signal (Down)

❻ **Up Output** : output for just the upward-shifted audio signal (Up)

3. Basic principles

Frequency shifting can slide an audio signal upwards ("UP Shift") or downwards ("DOWN Shift").

This is **not** the same as **transposition** (in which all of the components of an audio signal are raised or lowered by an equal interval).

With frequency shifting, all the **component harmonics of a sound are shifted** not by an equal musical interval, but **by the same frequency.**

As a rule, the resulting **output signal** is very likely to be **dissonant**, because the overtone frequencies are altered not by a proportional amount, but by exactly the same number of Hz. Think of a sawtooth with a 500 Hz fundamental, a first harmonic at 1 kHz, second at 1.5 kHz, and so on. If the signal is shifted upwards by 100 Hz the new fundamental will be 600 Hz, and the overtones 1.1 kHz, 1.6 kHz, etc.. These overtones are no longer perfect harmonics of the fundamental.

As with ring modulation, very complex, spectrally rich sounds often result.

4. Controls

① Level

Control ① is used to set the amount of **amplification** of the input signal at socket ❶.

② Overload

LED ② lights up when the input signal **overloads.**

③ Shift

The amount of **frequency shifting** is set manuallywith this control in a **range** from **c. 50 Hz to 4 kHz**.

④ CV

In addition to the manual control, the amount of frequency shifting can also be altered by a control voltage patched into input ❸; the **level of voltage control** can be set with attenuator ④.

⑤ Mix

Use control ⑤ to set the relative amounts of upward- and downward- shifted signals present at the mix output ❹. If the knob is turned fully clockwise or anti-clockwise, only one of the signals is audible:

Mix = 0 : just the downward-shifted signal is heard

Mix = 10 : just the upward-shifted signal is heard

5. In / Outputs

❶ Audio In

Socket ❶ is the frequency shifter's audio **input**. Use it to patch in the audio signal you want frequency-shifted.

❷ Audio Out

Output ❷ relays the **original signal**, amplified.

❸ CV 1

Patch a **control voltage for modulating the amount of frequency-shift** into socket ❸. The level of voltage control is set with attenuator ④.

As a rule, a slowly-changing voltage (e.g. LFO, ADSR, Random, etc.) or the CV output from a MIDI-CV-Interface (e.g. A-190, A-191) is used for this.

❹ Mix Output

Depending on the position of control ⑤, **output ❹** contains a **mix** of the downward and upward frequency-shifted signals.

❺ Down Output

Output ❺ contains just the **downward frequency-shifted signal**.

❻ Up Output

Output ❻ contains just the **upward frequency-shifted signal**.

6. User examples

A typical use for a frequency shifter is to transform the human voice - for instance, in a simple example, to produce ‘robot voices’.

A kind of **vibrato effect** can be produced by modulating the frequency-shift with a slow sine-wave from an LFO (frequency about 5 - 7 Hz).

More drastic effects can be produced by replacing the sine wave with a sawtooth (frequency about 1 - 2 Hz) to produce a repeated rising modulation.

With the patch in fig. 1 you can **‘roughen up’ audio signals** (e.g. voices) by modulating the frequency-shift with colored noise, and sending the original and the frequency-shifted signals to a mixer, to control the amount of **‘harshness’** or **‘edge’**.

With the patch in fig. 2, you can create a new type of percussive **stereo effect**, using the square wave from an LFO (frequency c. 5 - 6 Hz) to modulate the frequency-shift and continuously alter the side-bands. The Up and Down outputs are sent to left and right stereo channels respectively.

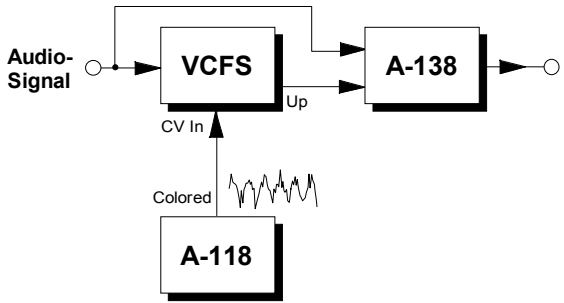


fig. 1: "roughening up” an audio signal

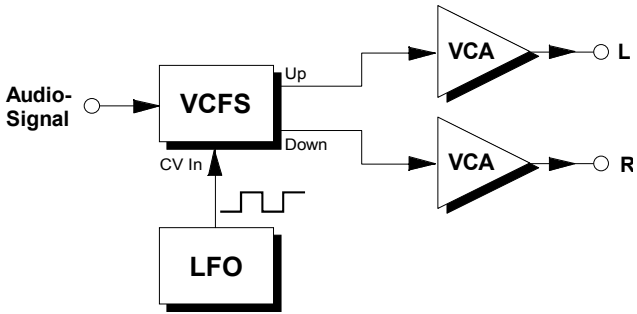


fig. 2: percussive stereo effect

If you increase the LFO frequency into the audio range (above about 20 Hz), other effects are produced.

Particularly if the LFO frequency is harmonically related to the fundamental of the audio signal, this can be a very pleasing effect.

One popular effect in the past was to **frequency-shift an octave band of sound**, produced by band-pass filtering the output from a noise module (see fig. 3).

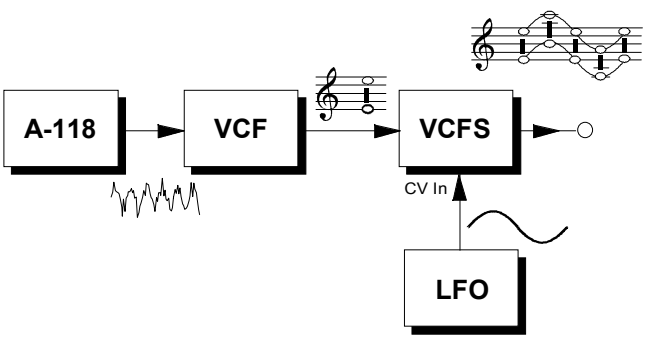


fig. 3: frequency-shifting an octave band

Interesting and unusual **percussion sounds** can be produced with the patch in fig. 4.

In this patch, a percussive sound (e.g. kick drum, snare) is fed into the frequency shifter. Using the shift control, you can then alter the apparent size of the instrument.

By deriving a trigger or gate signal from the drum, and controlling the frequency shifting with a short envelope, some effective and exciting percussion sounds emerge.

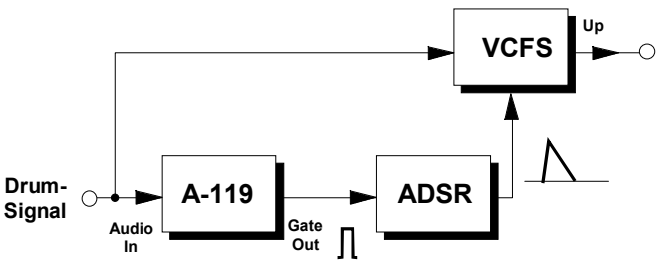


fig. 4: using the A-126 for new percussion sounds

Very interesting sound textures can result from a **combination** of **frequency shifting and frequency modulation** (see. fig. 5).

Just combining the two VCOs with frequency-shifting and FM can produce a wide range of massive sounds, and adding dynamic control of the frequency-shifting by using an ADSR can make them even more interesting. A whole new category of sounds is waiting to be explored.

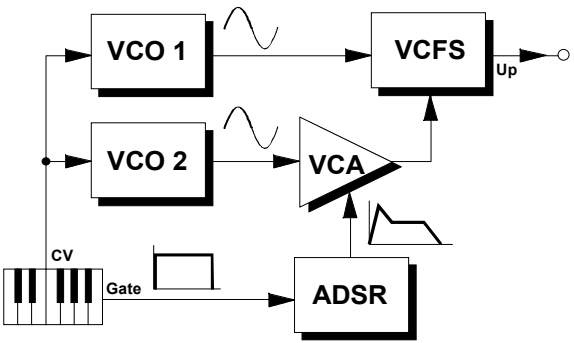


fig. 5: combining frequency-shifting and FM

By using a mixer module A-138b, and altering the relative levels of the Up, Down and original signals, the tonal possibilities of the frequency shifter can be expanded still further.

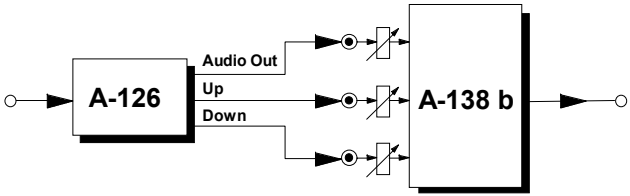


fig. 6: mixing the Up, Down and original signals to produce your chosen blend of sound

7. Patch-Sheet

The following diagrams of the module can help you recall your own **Patches**. They're designed so that a complete 19" rack of modules will fit onto an A4 sheet of paper.

Photocopy this page, and cut out the pictures of this and your other modules. You can then stick them onto another piece of paper, and create a diagram of your own system.

Make multiple copies of your composite diagram, and use them for remembering good patches and set-ups.

- Draw in patchleads with colored pens.
- Draw or write control settings in the little white circles.